Rainforest CRC Cooperative Research Centre for Tropical Rainforest Ecology and Management

PROJECT 2.5
Impacts of Climate Change on Rainforest Ecosystems and Biodiversity

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We are headed for a *super interglacial* with warmer conditions than the earth has experienced for millions of years. Almost nothing is known about how this will impact Australia's unique rainforest ecosystems and biodiversity.

Predicted warming for coastal north east Queensland is 1.4 to 5.8 degrees Celsius by 2100, relative to 1990 with +4% to -10% changes in rainfall per degree of warming (Walsh *et al.* 2000). More El Niño like conditions through this century are likely and tropical cyclone intensity may increase (Walsh and Ryan 2000). Simulations show that the relative humidity surface will shift upwards on tropical mountains by hundreds of metres during the winter dry season (Still *et al.* 1999) and cloud forests are particularly likely to display climate change effects in the very near future (Foster 2001, Loope and Giambelluca 1998).

Due to this rapid climate change, the biodiversity and regionally endemic species that are keystone elements in the Wet Tropics World Heritage Area and elsewhere in Queensland will be under severe threat over the next few decades. Massive loss of habitat leading to significant loss of biodiversity is possible. Additionally, ecosystem processes and the provision of ecosystem services could be severely impacted by climate change. Our preliminary analyses demonstrate the great sensitivity of rainforests to climate change (Hilbert *et al.* 2001, Williams unpublished) and suggest that it is imperative NOW that we understand ecological patterns and processes over large spatial and temporal scales in the region and develop predictive tools to enable realistic conservation planning for the continued preservation of the unique biota and ecosystems of the Wet Tropics and other rainforests in Queensland.

Critical information we do not have but will address in this project includes:

(1) A quantitative understanding of climatic and edaphic controls on upland rainforest types (e.g. simple notophyll vine forests, simple microphyll vine forests, simple microphyll vine thickets, and Notofagus forests) and their potential distributions under climate change.
(2) Knowledge of the distributions and climatic requirements of most highland species or how they will be affected by climate change.
(3) The geographic extent and location of suitable habitats for various species, including many

endemics, with climate change.
(4) Whether some locations will act as refugia in the coming super interglacial.
(5) Whether current conservation boundaries and off -reserve policies will be effective with increasing warming and other climate changes.
(6) Areas where interactions among global change drivers (climate change, clearing, invasions, and elevated carbon dioxide) are particularly threatening.

Combining long-term monitoring, development of one of the most detailed databases on a tropical rainforest in the world, and sophisticated modelling tools for predictive power will put the Rainforest CRC at the forefront in understanding the determinants of tropical biodiversity, conservation planning and will produce outcomes of international significance in many areas of global change ecology and conservation biology.

POSTGRADUATE STUDENTS

Kim HAUSELBERGER (JCU) PhD
The ecology of microhylid frogs
Jeff MIDDLETON (JCU) PhD
The effects of intra-annual rainforest variation on the patterns of diversity and abundance of leaf-litter foraging rainforest vertebrates
Collin STORLIE (JCU) Masters
The effect of moisture seasonality on Microhylid frog abundance and phenology.
Brett TAYLOR (GU) Honours
The process and biodiversity of leaf litter decomposition along an altitudinal transect in subtropical rainforest

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